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THE ALGAL FLORA AND ITS SEASONAL ASPECTS IN THE KÖRTVÉLYES AND MÁRTÉLY BACKWATERS OF THE TISZA

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Abstract

In the Körtvélyes and Mártély backwaters of the Tisza the algal flora was studied during several periods. The water of both backwaters is eutrophized, particularly in the Körtvélyes one. It is well seen in Table I, that since 1981 the number of Euglenophyta spp. has been relatively great in the backwater Körtvélyes, suggesting that the waste waters discharged there contained dung materials. Changes in the composition of the phytoplankton are also in support of the afct that the algae do not utilize only mineral salts, but also amino acids, carbohydrates, vitamins of decomposing organic materials as well as plant hormones. This should be also considered when establishing the indicator value of algae. Saprobity and trophity are mutually related not only because the organic materials producing saprobity increase trophity, but also because the algae are able to directly incorporate some of the organic materials. Mixotrophy can also exhibit differences within one species. The consideration of these facts may be of help in the evaluation of indicator organisms and through that in the accomplishing of a more real biological water qualification.

Introduction

The algal flora of the Körtvélyes and Mártély backwaters of the Tisza river habe been studied for several years. These examinations were started in the backwater at Mártély in 1953—1954. The reason for choosing this place was not only its easy approachability but also the fact that this nice place had been used also earlier as a holiday resort. Since this area together with the backwater Körtvélyes was placed under nature conservation control, the two backwaters and their environment are known today by the name Mártély nature conservation area. Since 1973 the studies on the changes of the algal flora have been extended over the backwater Körtvélyes. The analysis of the algal flora of the backwater Mártély was performed by myself from 1953 to 1954, from 1966 to 1968, from 1972 to 1975 and since 1981. The phytoplankton of the backwater at Mártély was studied by UHERKOVICH from 1967 to 1968 in connection with the thorough investigations performed for a longer period on the algae of the Tisza river and its tributaries (UHERKOVICH 1967a, b, 1971).

In addition to the results of basic research, the experiences obtained can be also very useful in regard of environmental protection, particularly in the field of biological water qualification. This applies especially to the Körtvélyes backwater. In biological water qualification the use of algae as indicator organisms can complement resp. support the results of the chemical qualification of water, and can also furnish us with valuable information from other aspects, too. Nevertheless, the investigations with algae as indicator organisms should be placed on plant physiological foundations and in this regard particular emphasis must be laid on the full knowledge of the forms and possibilities of nutrition af algae, namely, not only the nutritional role of inorganic compounds, cations and anions dissolved in the water should be taken into consideration, but also such results according to which the algae are able to take up and incorporate certain organic compounds of decomposing materials which get into the water as pollutants. We think that this fact has not been given to date the deserved attention in the evaluation of indicator organisms, and through that in the biological qualification of waters, albeit this deficiency may have been the source of many problems. It seems that the differences in opinion in connection with algal indication are occasionally resolved just by the contradictory ideas, and more thorough investigations in this line.

Not only the cations and anions of inorganic compounds serving as food for plants represent the direct source of eutrophication in our natural waters. It has become increasingly evident that the incorporation by algae of some organic compounds polluting the waters results in the rapid enrichment of the algal vegetation. This phenomenon could be clearly observed in the Mártély backwater, especially in the Körtvélyes one. Therefore, in the following we shall deal with the stimulating effect of these organic materials in a greater detail in connection with analysis of the phytoplankton of the two backwaters.

Material and Method

It is not possible to give space in this paper to the detailed presentation of the vast material on the algal flora. Therefore, the initial and the last conditions will be compared in a tabulated form for illustrating the seasonal changes of phytoplankton (Table 1). In the table the seasons are marked with letters: a = spring, b = summer, c = autumn. The taxonomic determination of algae was made in living condition, while fixed material was used for the study of the quantitative relationships. The relatively simple "drop method", developed by us earlier, was used to reveal the quantitative relationships of the phytoplankton. The course of this process is the following: from the sedimented seston of each liter fixed material, a concentrate of 10 ml was prepared. After thorough shaking, one drop was taken from this concentrate with a standard pipette for wet preparation the volume of which was 50 mm^3 on the average. The quantitative relationships of each water sample were determined on the basis of 10 wet preparations with 5 grades. The grades 1—5 figure in the seasonal columns (a, b, c) of Table I and their meaning is the following: 1 = rare organism in the water sample (only 1—5 specimens occurred in the 10 preparations). 2 = sporadic occurrence (in 10 preparations only 6—10 individuals were visible), 3 = frequent occurrence (there) were a few individuals in a single preparation), 4 = very frequent occurrence (several individuals (15—20) were found in a single preparation), 5 = mass production of bloom (the water possessed a grean colour due to the great number of organisms). This method is relatively rapid and the first two grades can be expressed with approximate value in terms of liter. Since the volume of the drop. resp. the wet preparation is known, concrete counting is also possible by good approximation beyond the former grades and reckoning over into liter is also possible. In the case of filamentous algae, the quantitative grades were determined by estimation on the basis of the number of places of collection, the area of extension of the particular population and the density of the filaments.

Results and discussion

During the investigations performed in the Mártély and Körtvélyes backwaters of the Tisza for several years, the presence of 212 algal taxa (species, or their variations and forms) were established. The two backwaters are very near to each other on the left bank of the Tisza, and therefore did not exhibit great differences in the systematic composition of their algal flora. Both of them are in the flood area inside the bank, and in the period of flood are inundated, their beds are practically "flushed", and the greatest part of their water exchanged by the water of the Tisza. This produces such interactions in the biota here which are not yet clearly understood. Both backwaters have eutrophized: the Mártély one gradually, the Körtvélyes one rapidly. Because of that, algal mass productions have been observed in both of them. In the backwater Mártély the massive bloom of Eudorina elegans was observed during summer 1968 and 1973 (KISS 1977a), and in smaller areas the water possessed a green colour in summer 1979 due to the bloom of *Chlamydomonas intermedia*. In late autumn, 1973, in the littoral zone of the backwater Körtvélyes, Scenedesmus ecornis produced a vegetational discoloration of water vegetation and showed considerable morphological variability (KISS 1977b).

Table I presents the following picture in connection with the qualitative and quantitative changes of phytoplankton:

1. In each listed seasonal sample taken from both backwaters, the following algae were present: *Aphanizomenon flos-aquae, Caloneis amphisbaena, Tetraedron muticum, Dictyosphaerium pulchellum, Scenedesmus acuminatus, Tetrastrum staurogeniaeforme, Actinastrum Hantzschii, Cladophora fracta.* The seasonal tolerance and the tolerance of environmental factors are obviously very great with these species, and their sociability is also the greatest under the given conditions. There were, however, some algae which occurred only in one of the two backwaters. The following species were missing from the backwater of Mártély: *Lyngbya saxicola, Euglena charkowiensis, Euglena chlamydophora, Lepocinclis Steinii, Phacus helicoides, Phacus tortus, Trachelomonas crebea, Trachelomonas granulosa, Trachelomonas intermedia Trachelomonas verrucosa, Strombomonas verrucosa* var. *genuina, Strombomonas Deflandrei, Centritractus belonophorus, Centritractus rotundus, Nitzschia hungarica, Nitzschia palea, Lagerheimia wratislaviensis* var. *mixta, Golenkinia radiata.* From the Körtvélyes backwater, however, only two species were missing: *Phormidium molle* and one *Gongrosira* sp. These differences of occurence cannot be said to have been essential in regard of the quality of the algal flora, since they just point to the fact that the majority of the species was identical in the two backwaters (of the 212 taxa 192 were common). After all 210 taxa occurred in the Körtvélyes backwater and in the Mártély one 194. This is not a great difference.

2. On the other hand, the numerical differences will become very great when comparing the initial period of these studies with the observations in 1981. We can see the very surprising phenomenon, that in the Körtvélyes backwater the algal flora enriched rapidly during a period of not quite ten years, and instead of the 84 species observed in 1973, 193 species occurred in 1981. In the backwater of Mártély, on the other hand, 148 algal species occurred in 1953, and this number increased only to 179 during a period of almost three decades, i.e. by 1981. This increase looks small relative to that in the Körtvélyes backwater, where the considerable enrichment was connected with the twofold resp. manyfold increase in the number of species of each phylum, with the exception of Cyanophyta. During the 9 years from 1973 to 1981 e.g. the number of green algal species increased from 40 to 100, the number of species belonging to Euglenophyta from 4 to 45, i.e. elevenfold. Doubling occurred in the phyla Chrysophyta and Pyrrophyta, as well.

3. Compared with the increase of species number of the four aforementioned phyla, the number of the species of Cyanophyta decreased to one third. During 1981 only 5 species could be recovered from the 16 ones. *Aphanizomenon flos-aquae* was

frequent in the water samples taken in spring and autumn, and proved to be very frequent in the summer samples. *Anabaena spiroides* occurred only in summer and autumn, *Spirulina laxissima, Oscillatoria planctonica* and *Lyngbya limnetica* only during summer. This decreased frequency of the phylum Cyanophyta is difficult to explain. It is likely that the increase of Euglenophyta or some environmental factor promoting it inhibited the growth of the disappeared Cyanophyta spp. Nevertheless, *Aphanizomenon flos-aquae* proved to be tolerant of this inhibiting factor, too.

4. The above-mentioned increase of Euglenophyta deserves our attention not only because with it the whole picture of the algal population changed, but also from the aspect of the physiology of nutrition of Euglenophyta spp. This latter severely affects the question of biological water qualification in regard of algal indication. It should be stressed first of all that, according to Table 1, the 4 species of Euglenophyta observed during summer 1973 occurred only sporadically near the inflow of the sewer, and were not to be found at the basic point of samplings, in the direction of the landing-stage and the places where the meterological instruments were planted. By 1981 this difference ceased, the algal flora was practically identical in each place of collection. Since 1973 pollution has shown an increasing tendency. Since 1930 it could be observed that the mass growth of algae was greatly enhanced by the stimulating organic materials polluting the water. In alkaline waters ("sodaic waters") of high salt concentration and high pH value, too, there was a surprisingly rich and varied Euglenophyta vegetation if decomposing materials e.g. dung water was discharged into the water (Kiss 1939, 1942, 1968, 1970a, b, c, 1972—1975, 1976). It seems that these organic materials are not directly nutrients only, but can also exert a "protecting function" against the damages which may be caused by high salt concentration, resp. high values of osmosis and alkalinity. Only later have we obtained knowledge of the fact that Välikangas had also observed a similar phenomenon in Finland: the ice in the Helsinki harbour and the brackish water underneath were discoloured by *Euglena viridis*. This phenoumenon occurred, however, only in the place of discharge of metropolitan sewage (Välikangas 1921—22). The *Euglena viridis* is an eurytherm organism which, in the presence of stimulatory compounds, is able to form mass-productions even during the winter.

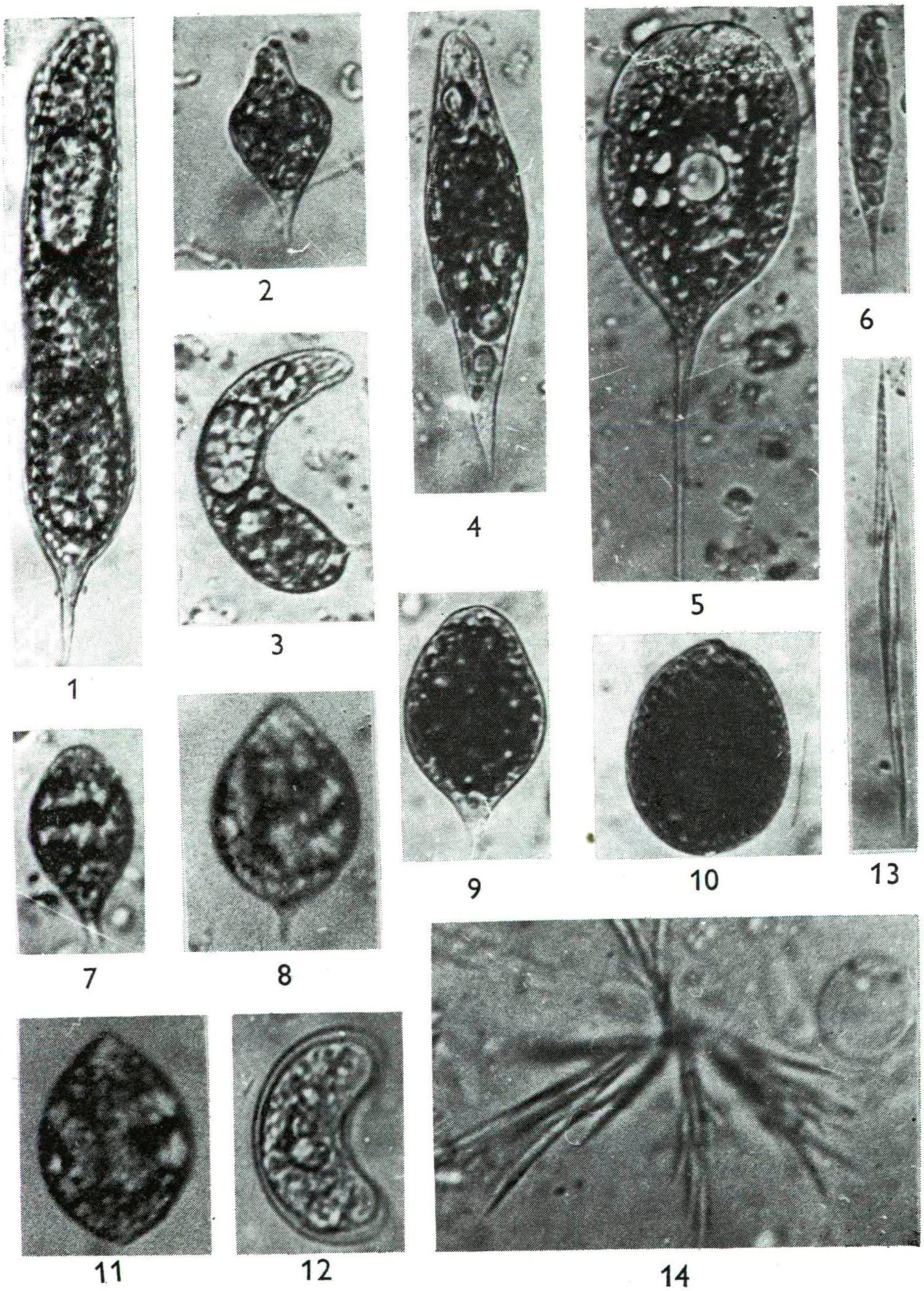
5. Physiological experiments performed with algae suggested that these stimulating materials might be protein constituents, amino acids, vitamins or hormones, which were utilized and incorporated particularly by the members of the phylum Euglenophyta. To study the grwoth and reproduction processes of *Trachelomonas crebea,* pea brew nutrient solution was prepared in 1935 to which some lemon juice was added. On the effect of the medium containing vitamin C and much organic

Plate I

1. *Euglena oxyuris* var. *minor* Defl. 700:1
2. *Euglena pisciformis* Klebs 800:1
3. *Euglena charkowiensis* Swirenko 700:1
4. *Euglena thinophila* Skuja 1000:1
5. *Phacus longicauda* (Ehr.) Duj. 600:1
6. *Euglena chlamydophora* Mainx 800:1
7. *Lepocinclis acuta* Presc. 900:1
8. *Lepocinclis ovum* (Ehr.) Lemm. 900:1
9. *Lepocinclis texta* var. *mamillata* (Da Cunha) Conr. 700:1
10. *Lepocinclis texta* (Duj.) Lemm. 600:1
11. *Lepocinclis fusiformis* (Carter) Lemm. 800:1
12. *Nephrochlamys allanthoidea* Kors., forma 1500:1

13—14. *Ankistrodesmus acicularis* (A. Braun) Kors. 800:1

Plate I



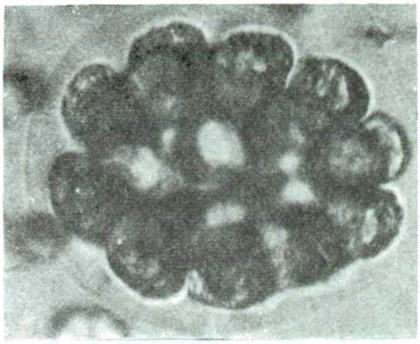
nitrogen, the cell division of *Trachelomonas* took place also in the naked form through several generations. The young cells sometimes did not separate from one another but remained joined at their basal parts, producing bicellular pseudocolonies. In some cases the cells of the two-celled pseudocolonies. In some cases the cells of the two-celled pseudocolony divided again and produced four-celled pseudocolony. We succeeded in transforming the unicellular alga into multicellular forms at a later date, too (KISS 1939, 1960, 1973). This finding is believed to be the result of increased nutrition and accelerated cell division. In his excellent book PÉTERFI (1977) also refers to the facultative heterotrophy of flagellates and their vitamin C auxotrophy. He claims that in his experiments the filamentous green alga Microthamnion grew well on glucose medium even in complete darkness. He also mentions the results obtained by MIHNEA et al. according to which the organic materials added to the medium enhanced protein and carbohydrate synthesis of a few unicellular algae and stimulated cell division both in light and darkness. According to the investigations performed by UHERKOVICH (1956), *Scenedesmus quadricauda* exhibited very intensive growth in a medium of optimal mineral salt content when vitamin B_1 was added to the medium, and produced large cells on the effect of vitamin PP and broad cells in vitamin B_6-containing medium. Larger doses of vitamin B_1 inhibited cell division. He also observed that some *Scenedesmus* strains isolated by FELFÖLDY and KALKÓ did not react in the same way to the addition of aneurin (UHERKOVICH 1965). KESSLER and CZYGAN (1970, 1972) examined 71 strains of 8 autotrophic species of *Chlorella* in regard of the utilizability of 5 organic nitrogen compounds. They stated that in light the use of glutamine acid produced good growth in the case of 63 strains, while that of glutamine good growth in the case of 67 ones. Purine was utilized in growth by 16 strains, nicotinic acid amid by 9 strains and nicotinic acid only by one strain. The possibility of utilization of 6 organic carbon sources was also examined. In darkness good growth was observed following acetate addition in the case of 72 strains belonging to the 10 autotrophic species of *Chlorella* and following glucose addition in the case of 37 strains belonging there. Utilization of fructose was satisfactory with 21 strains, that of galactose with 11 strains, while in the case of saccharose and lactose intensive growth was not evident. The organic compounds investigated were utilized readily by some strains by others less readily, meaning that utilization was selective. Of the plant hormones, auxin is the most important in regard of Körtvélyes, because it is present in a great quantity in animal dungs. It is not species specific and is effective only in optimal quantity, in higher concentrations it is inhibitory. Its role may change according to the type of alga, indicating that selectivity applies to it, as well.

The few examples presented here from among the many data, basically affect he question of saprobity-trophity possessing a key position in biological water

Plate II

1. *Pandorina charkowiensis* KORS. 1000:1
2. *Pandorina morum* (MÜLLER) BORY forma 1000:1
3. *Eudorina cylindrica* KORS. 700:1
4. *Tetraedron proteiforme* (TURN.) BRUNNTH. 500:1
5. *Pediastrum simplex* MEYEN 500:1
6. *Crucigenia tetrapedia* (KIRCHN.) W, et G.S. West 600:1
7. *Oocystis Marssonii* LEMM. 800:1
8. *Pediastrum tetras* (EHR.) RALFS 1000:1
9. *Strombomonas verrucosa* var. *zmiewika* DEFL. 600:1
10. *Dictyosphaerium pulchellum* WOOD 700:1

Plate II



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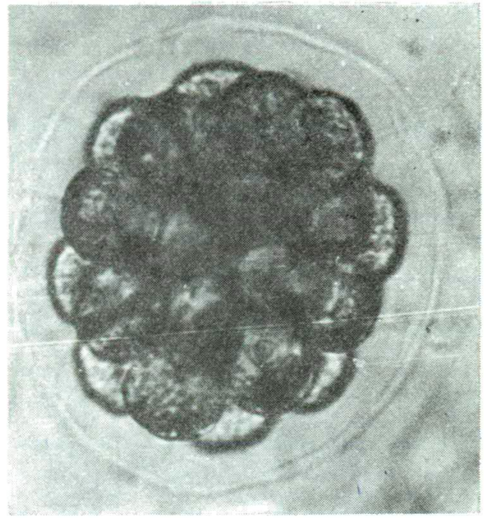

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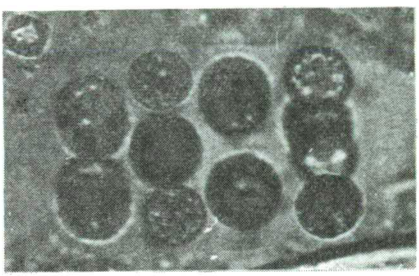

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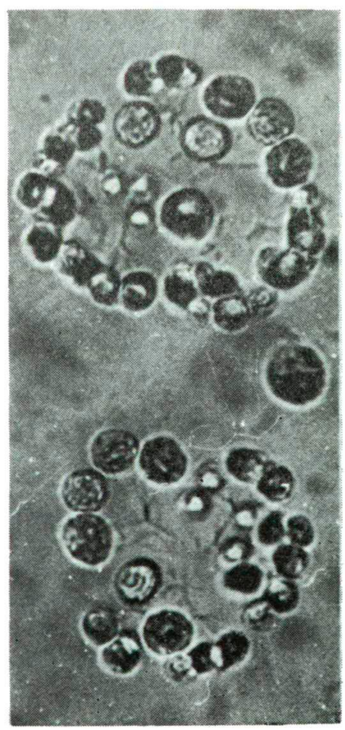

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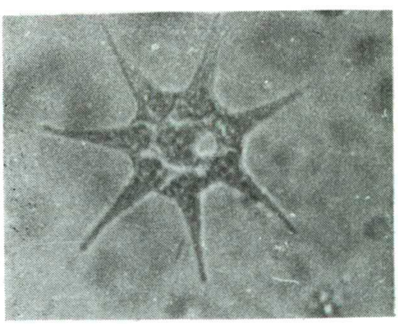

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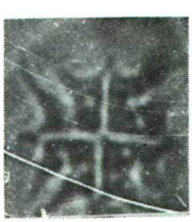

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Table 1

Sor-szám	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
	Phylum: Cyanophyta												
1.	*Gomphosphaeria aponina* KÜTZ.	1	3	2					2	2		2	
2.	*Merismopedia glauca* (EHR.) NAEG.	1	3	2					2				
3.	*Dactylococcopsis raphidioides* HANSG.	2	3	3				1	2	2			
4.	*Aphanizomenon flos-aquae* (L.) RALFS	2	4	4	3	4	3	2	4	3	3	4	3
5.	*Anabaena spiroides* KLEBAHN	2	4	4		2	1	1	3	2		3	2
6.	*Spirulina laxissima* G. S. WEST	1	2			3			2	2		2	
7.	*Sp. subtilissima* KÜTZING	1	2	2				2	2	3		2	
8.	*Oscillatoria angustissima* W., G.S. WEST		2						1	2	1	2	
9.	*O. plantonica* WOLOSZ.	2	3	3		2			2	1	1	2	1
10.	*O. tenuis* AGARDH	2	3	1				1	2	1			
11.	*Phormidium foveolarum* (MONT.) GOM.	2	3	3				1	2	2		2	
12.	*Ph. molle* (KÜTZ.) GOM.							2	2	2		1	
13.	*Lyngbya bipunctata* LEMM.		2	2				1	2	1		2	
14.	*L. circumcreta* G.S. WEST	2	2						2	2			
15.	*L. limnetica* LEMM.	2	3	3		2			2	2		2	1
16.	*L. Martensiana* MENEGH.	2	3	2					3	4			
17.	*L. saxicola* FILARSZKY	1	2										
	Phylum: Euglenophyta												
1.	*Euglena acus* EHRENBERG				2	3	1		2	1		2	2
2.	*E. charkowiensis* SWIR.				2	3	2						
3.	*E. chlamydophora* MAINX				1	2	2						
4.	*E. Ehrenbergii* KLEBS		2		1	3	2			2		2	1
5.	*E. limnophila* LEMM.				2	3	1				1	2	1
6.	*E. oxyuris* var. *minor* DEFL.				3	3	3		2		1	2	2
7.	*E. pisciformis* KLEBS				2	3	1				1	1	
8.	*E. polymorpha* DANG.				2	3	2		2		2	2	2
9.	*E. proxima* DANG.				1	2	2				1	2	
10.	*E. oblonga* SCHMITZ				1	3	1				2		
11.	*E. thinophila* SKUJA				1	2			1	2	2	2	1
12.	*Lepocinclis acuta* PRESC.		2		1	2	2	1	2		2	3	2
13.	*L. fusiformis* (CARTER) LEMM.		2		2	3	2		1	2	1	1	
14.	*L. Nayali* CONRAD				1	3	2		2	1		2	
15.	*L. ovum* (EHR.) LEMM.		2		1	3	2	1		2	2	3	1
16.	*L. ovum* var. *angustata* (DEFL.) CONR.				1	2			2	2		1	
17.	*L. Steinii* LEMM.				2	2							
18.	*L. teres* (SCHMITZ) FRANCÉ				2	3	2			2	2	3	2
19.	*L. texta* (DUJ.) LEMM.				1	3	2		2			2	
20.	*L. texta* var. *mamillata* (CUN.) CONR.				1	3	1			1		1	
21.	*Phacus acuminatus* STOKES				1	2					1	2	
22.	*Ph. alatus* KLEBS				2	2	1		2		1	2	
23.	*Ph. brevicaudatus* (KLEBS) LEMM.				1	2					1	2	
24.	*Ph. caudatus* HÜBNER				1	2	1				1	2	
25.	*Ph. curvicauda* SWIR.				1	2	1		2		1	1	
26.	*Ph. longicauda* (EHR.) DUJ.				2	3	2		1	1	1	2	
27.	*Ph. helicoides* POCHMANN				1	2	1						
28.	*Ph. tortus* (LEMM.) SKWORTZ.					2	2						
29.	*Trachelomonas angustata* DEFLANDRE					1	2		2			2	
30.	*Tr. conica* PLAYFAIR				1	2	1			2		2	
31.	*Tr. crebea* KELLICOTT					1	2						
32.	*Tr. Dybowskii* DREZ.					2	2					2	

	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
33.	*Tr. granulosa* PLAYF.				1	2	1						
34.	*Tr. hispida* (PERTY) STEIN				1	1			2			2	
35.	*Tr. intermedia* DANGEARD				2	2							
36.	*Tr. Mangini* DEFL.				1	2			2		2		
37.	*Tr. oblonga* var. *truncata* LEMM.				1	2			2		2		
38.	*Tr. scabra* PLAYF.				1	3	2		2		1	3	1
39.	*Tr. verrucosa* STOKES				2	2							
40.	*Tr. volvocina* EHR.				3	3	3	1	2		3	3	3
41.	*Tr. volvocina* var. *derephora* CONR.				2	3	2			2		2	1
42.	*Strombomonas fluviatilis* (LEMM.) DEFL.				1	3	2			2		2	
43.	*Str. verrucoca* var. *genuina* DEFL.				1	2							
44.	*Str. verrucosa* var. *zmiewika* DEFL.				1	3	2					2	
45.	*Str. Deflandrei* (ROLL) DEFL.				2	1							
	Phylum: Chrysophyta												
	Classis: Chrysophyceae												
1.	*Kephyrion Rubri-claustri* CONR.					1	2		2	1		2	2
2.	*Chrysococcus rufescens* KLEBS				1	2			1	3		2	
3.	*Pseudokephyrion conicum* SCHILLER		2	3	1	3	1		2		1	3	2
4.	*Dinobryon divergens* IMHOF	2	2	1	2	1			2	2	1	2	1
	Classis: Xanthophyceae												
5.	*Characiopsis acuta* BORZI				1	2	1	2	2		2		
6.	*Ch. minor* PASCHER					1	1		3				
7.	*Centritractus belonophorus* LEMM.				1	3	2						
8.	*C. rotundus* PASCHER				1	2							
9.	*Ophiocytium capitatum* WOLLE				2	3			2	1		2	2
10.	*Tribonema aequale* PASCHER				2				3			2	
11.	*Tr. minus* (WILLE) HAZÉN		2		2			3	1		3		
12.	*Tr.* species				2	2	1	3					
13.	*Vaucheria* species		2		2	3	2	2			2	3	
	Classis: Bacillariophyceae												
14.	*Melosira varians* C.A. AG.				2			1	2			2	
15.	*M. granulata* var. *muzzanensis* (MEISTER) BETHE		1		2	3		2	2		2		
16.	*Attheya Zachariasi* J. BRUN.	2	2		1	2		1	2			2	
17.	*Cyclotella Kuetzingiana* THWAIT.		1		1	2		1	1	2	2		
18.	*C. Meneghiniana* KÜTZ.		2		2	3	2	2	2	1	2	2	2
19.	*Diatoma vulgare* BORY		2	2		2		2	2			2	
20.	*Fragilaria capucina* DESMAZ.					1	1	2	2				2
21.	*Asterionlella formosa* HASSALL		1		1	2			2		2	2	
22.	*Synedra actinastroides* LEMM.		2		2	2		2	2		2	2	
23.	*Syn. acus* (KÜTZ.) HUST.					2		1	2			2	1
24.	*Syn. affinis* KÜTZING				1	1		1	1		2	2	
25.	*Eunotia praerupta* var. *inflata* GRUN.				2	2	1	1				2	
26.	*Gyrosigma acuminata* (KÜTZ.) RABH.		2		1	2	1	1	3	2	2	3	2
27.	*Caloneis amphisbaena* (BORY) CLEVE	2	2	2	2	3	2	2	3	3	2	3	2
28.	*Navicula cincta* (EHR.) KÜTZ.				1	2		2	1				
29.	*N. cryptocephala* KÜTZ.		1		2	1		1	2		1		2
30.	*Amphora venata* (KÜTZ.) HUST.			1	2	2	1	1	2			2	
31.	*Cymbella affinis* KÜTZ.			2	1	2			2		1	2	
32.	*C. cymbiformis* (AG.) KÜTZ.		1	1		2		1	2		1		
33.	*C. cistula* (HEMPR.) GRUN.				2	1		1					2
34.	*Gomphonema acuminatum* EHR.		2	1	2	2	1		3	2	2	2	
35.	*G. augur* EHRENBERG			1	2	2	1	2	2			2	

	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
36.	*Nitzschia acicularis* W. SMITH				1	2		1	2			2	1
37.	*N. capitellata* HUST.				2	2			2	1	1		
38.	*N. hungarica* GRUNOW		2	2									
39.	*N. palea* (Kütz.) W. SMITH			2	2	2							
40.	*Cymatopleura solea* (BRÉB.) W. SMITH	1			3	3	1	3	2	1	1	3	2
	Phylum: Pyrrophyta												
1.	*Glenodinium pulvisculus* (EHR.) STEIN		1		2	2		1	2		2		
2.	*Peridinium cinctum* (O.F.M.) EHR.				1	2		2					
3.	*P. palatinum* LAUTERBORN				1	1		1	2		1		
4.	*Ceratium hirundinella* (MÜLL.) SCHRANK		2	1	2	3	2		1	2	2	3	1
	Phylum: Chlorophyta Classis: Chlorophyceae Ordo: Volvocales												
1.	*Chlamydomonas intermedia* CHOD.				3	3	2	2	3		2	3	1
2.	*Chlamydomonas* spec.				2	3					2	2	
3.	*Carteria* spec.					2				1	2	2	
4.	*Eudorina cylindrica* KORS				2	2		2	3	1	2	2	
5.	*Eudorina elegans* EHRENBERG	1	2		2	3	2	2	2	1	2	3	2
6.	*Pandorina charkowiensis* KORS.				2	4	3			1	2	2	
7.	*Pandorina morum* (MÜLLER) BORY				1	3	2				1	1	
	Ordo: Chlorococcales												
8.	*Tetraedron caudatum* (CORDA) HANSG.		1		1	2	1	2	1	1	2	2	2
9.	*T. incus* (TEIL) G.M. SM.				2	2	2				2	1	1
10.	*T. minimum* var. *apiculatum* REINSCH				1	2	2					2	
11.	*T. muticum* (A. BR.) HANSG.	1	2	1	2	3	2	1	1	1	2	1	2
12.	*T. proteiforme* (TURN.) BRUNNTH.		1		1	3	2					1	2
13.	*T. trigonum* (NAEG.) HANSG.					2	1		2	1		2	1
14.	*Schroederia setigera* (SCHRÖD.) LEMM.				1	2		1	2		2	2	1
15.	*Characium Naegelii* A. BRAUN					2	1					1	2
16.	*Oocystis cingulatus* HORTOB. et NÉM.				1	2	2				1	2	
17.	*O. Marssonii* LEMM.	1			1	2	1		2	2	1	2	2
18.	*O. ovale* KORS.				2	2	1				1	2	
19.	*Chodatella citriformis* SNOW				1	1					1	1	
20.	*Ch. ciliata* (LAGERH.) LEMM.				1	1			1	2	1	2	1
21.	*Coenocystis planctonica* KORS.					2	1				1		
22.	*Coe. reniformis* KORS.				1	2					1	2	
23.	*Gloeoactinium limneticum* G.M.SM.				1	2		1	2		1		
24.	*Lagerheimia Griffithsii* FOTT				1	1			2	1			
25.	*L. wratislaviensis* var. *mixta* HORTOB.				1	2							
26.	*Franceia droescheri* (LEMM.) KORS.				2				2		1	1	
27.	*Chodatellopsis elliptica* KORS.				1	1					1		
28.	*Nephrochlamys allanthoidea* KORS.		1		2	3	3	2	3	2	2	3	2
29.	*N. subsolitaria* (G.S. WEST) KORS.				1	2	2	1	2	2	1	1	1
30.	*Kirchneriella contorta* var. *lunaris* RICHTER		1	1	1	2	1					2	
31.	*K. obesa* (W. WEST) SCHMIDLE				1	1	2	1	2	1	1	2	1
32.	*Selenastrum Westii* G.M. SM.				1	2	2				1	2	
33.	*S. gracile* REINSCH					2	1	1	2				
34.	*Ankistodesmus acicularis* (A. BR.) KORS.	1	1		1	3	2		3	2		3	2
35.	*A. angustus* BERN.					2	2		3	2	2	2	2
36.	*A. arcuatus* KORS.					2	2				2	2	
37.	*A. falcatus* (CORDA) RALFS	1	2	1	1	2	2	1	2	1	1	2	1
38.	*A. setigera* (SCHRÖD.) LEMM.					2	1	2	2	3	2	2	2
39.	*Coenocystis planctonica* KORS.				1	1			2	2	1	2	

	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
40.	*C. reniformis* KORS.					1	2	1	2		1	2	1
41.	*Micractinium pusillum* FRES.					2	2	1	3		1	2	
42.	*Golenkinia paucispina* W., G.S. WEST					1	2		2	1			
43.	*G. radiata* CHODAT					1	1						
44.	*Golenkiniopsis solitaria* KORS.				2	2					1	2	
45.	*Dictyosphaerium pulchellum* WOOD	1	2	1	2	3	2	1	3	2	2	3	2
46.	*Didymocystis planctonica* KORS.					2	1	1	2		1	1	
47.	*Scenedesmus acuminatus* (LAGH.) CHOD.	1	1	2	2	3	3	1	2	1	2	3	3
48.	*Sc. acuminatus* f. *maximus* UHERKOV.			2	1	2	2	1	2	1		2	1
49.	*Sc. acuminatus* var. *elongatus* G.M. SM.					2	1				1	2	
50.	*Sc. acutus* (MEYEN) CHOD.		2	1	2	3	2	1	2			2	2
51.	*Sc. acutus* f. *alternans* HORTOB.				1	2	2					2	
52.	*Sc. acutus* f. *costulatus* (CHOD.) UHERKOV.					1	1					2	
53.	*Sc. arcuatus* LEMM.				1	1		1	2	1	1	2	
54.	*Sc. denticulatus* KIRCHN.		2	3	1	3	2				2	2	1
55.	*Sc. denticulatus* var. *linearis* HANSG.				1	2	2		2	3	1	1	
56.	*Sc. dispar* BRÉB.				1	1	2		3	2	1	2	1
57.	*Sc. ecornis* (RALFS) CHOD.		1	5	1	2	2	1	2	2	2	2	2
58.	*Sc. ecornis* var. *disciformis* CHOD.		2		2	3	2				1	2	1
59.	*Sc. ellipsoideus* CHOD.				1	2	2	1	2	1	2	2	2
60.	*Sc. intermedius* CHOD.		1	1	1	2	2		3	2	1	2	
61.	*Sc. intermedius* var. *bicaudatus* HORTOB.				1	2		1	2	1	2	2	1
62.	*Sc. nanus* CHODAT				1	1	1					2	
63.	*Sc. obtusiusculus* CHOD.				1	2					2	1	
64.	*Sc. opoliensis* P. RICHT.		2		2	3	2				1	3	2
65.	*Sc. tibiscensis* UHERKOV.					2	1				2	1	
66.	*Sc. quadricauda* (TURP.) BRÉB.		2		2	3	3	2	3	3	2	3	3
67.	*Sc. quadricauda* var. *biornatus* KISS I.				1	1		1	2		2	2	
68.	*Sc. spinosus* CHODAT				2	2	2				2	1	
69.	*Coelastrum microporum* NAEG.			1	1	2	2	1	2	2	1	3	2
70.	*C. pseudomicroporum* KORS.	1	2	1	2	3	3		2	1	2	2	1
71.	*C. sphaericum* NAEG.				1	2				[illegible]	2	3	
72.	*Crucigenia rectangularis* (NAEG.) GAY.				2	2	1	1	1	2	1	2	1
73.	*Cr. tetrapedia* (KIRCHN.) W., G.S. WEST			1	2	3	3		2	1	2	3	2
74.	*Cr. truncata* G.M. SM.				1	2	2				2	2	1
75.	*Cr. quadrata* MORREN					2	1	1	2	2	1	3	2
76.	*Tetrastrum staurogeniaeforme* (SCHRÖD.) LEMM.	1	2	1	2	3	1	2	3	2	2	3	2
77.	*Actinastrum Hantzschii* LAGERH.	1	2	2	2	3	3	1	2	3	2	3	2
78.	*Pediastrum Boryanum* (TURP.) MENEGH.		1	1	1		2	1		2	2	2	1
79.	*P. Boryanum* var. *brevicorne* A. BR.				1		1				2	2	1
80.	*P. Boryanum* var. *longicorne* REINSCH					2	1		2	2		2	1
81.	*P. duplex* MEYEN				1	2	2	2	2	1	1	2	1
82.	*P. simplex* MEYEN				1	2	2	1	3	2	1	2	2
83.	*P. tetras* (EHR.) RALFS					2	1				1	2	
84.	*Elakothrix gracilis* HORTOB.					2	1				1	2	
	Ordo: Ulotrichales, Oedogoniales, Siphonocladales												
85.	*Uronema confervicolum* LAGERH.		1	2		1	1		2			1	1
86	*Stigeoclonium Huberi* HEER.	1	3	1	2	2	1		1	2	2		
87.	*Gongrosira* spec.							2	3				
88.	*Aphanochaete repens* A. BRAUN		2									1	
89.	*Oedogonium* spec.					2		2	2	3	2	2	
90	*Bulbochaeta* spec.		2	1				2	2				
91.	*Cladophota fracta* KG. ampl. BRAND	2	2	2	2	3	2	3	3	3	3	3	3

	Species (taxon)	Körtvélyes						Mártély					
		1973			1981			1953			1981		
		a	b	c	a	b	c	a	b	c	a	b	c
	Classis: Conjugatophyceae Ordo: Desmidiales												
92.	*Closterium acutum* Bréb.		2		2	2	1	2	1		2	2	
93.	*Cl. attenuatum* Ehr.				1	1					1		
94.	*Cl. gracile* var. *elongatum* W., G.S. West	2	2		2	2	1	1	2		2	2	
95.	*Cl. strigosum* Bréb.				2	1					1	2	
96.	*Cl. subulatum* (Kütz.) Bréb.					1		1	2		1		
97.	*Cosmarium granatum* Bréb.		2		2			2	2	1	1	2	1
98.	*C. laeve* Rabenhorst	2	1								2		
99.	*C. subtumidum* Nordst.					1			2		1		
100.	*Spirotaenia obscura* Ralfs				1			1	2	1	1		
	Ordo: Zygnemales												
101.	*Spirogyra decimina* (Müller) Czurda	3	2		2			2	3		3		
102.	*Sp. fallax* (Hansg.) Wille	2						2	2		2		
103.	*Sp. insignis* (Hass.) Czurda		2		2			3	2		3		
104.	*Sp. lacustris* Czurda	2				2		2	2				
105.	*Sp. nitida* (Dillwyn) Link		2					1	2				
106.	*Mougeotia laevis* (Kütz.) Archer		1	2		2		2			3		

qualification. These namely do not only suggest that by the mineralization of organic materials causing saprobity trophity increases, but also that the algae — by virtue of their physiological nature — are able to utilize and incorporate directly the decomposing organic materials, amino acids, vitamins, carbohydrates and hormones. It is obvious that these facts should also be considered in the biological water qualification in order to obtain more concrete results. For the sake of a better approach of the real situation, allowance should be made also for the fact that in the utilization of organic materials differences can occur according to intraspecific biotypes and strains with genetically fixed properties can also occur. On the basis of the foregoing it is possible to explain why the individuals of the same species exhibit different behaviour under completely identical conditions. These considerations may help us to better understand the differences of opinion concerning indicator organisms, since even contradictory views can reflect reality.

The more thorough study of the backwaters of the Tisza is very actual today. Hortobágyi was the first (1939, 1941a, b, 1942) to carry out studies in this regard and in his work published in 1939 he reported on the occurrence of 273 taxa in the "Nagyfa" backwater. He has complemented these investigations with further ones, moreover he found also a marine, brackish water algal species there which must have been introduced by migrating birds. Further data can be found in Uherkovich's works (1959, 1961a, b, 1963, 1967a, b, 1971) who extended his studies on the potamophytoplankton of the Tisza on the backwaters of the river, too. It would be most useful to compare the phytoplankton of the backwaters of the Tisza with one another resp. with that of the river itself. This would be essential not only from the aspect of basic research but also fom that of environmental protection.

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A Tisza körtvélyesi és mártélyi holt ágainak algarendszere és szezonális algatársulásai

I. KISS

Tiszakutató Munkacsoport, Szeged, Magyarország

Kivonat

A Tisza folyó Mártély község és Körtvélyes melletti holtágainak algaflóráját több ciklusban tanulmányoztuk. Mindkettőnek vize eutrofizálódott; különösen a mártélyi holt ágé. Az 1. sz. táblázatban jól látható, hogy a körtvélyesi holt ágban 1981-től viszonylag sok Euglenophyta species szerepel, amelyek az ide jutó szennyvízben trágyaanyagok jelenlétére mutatnak. Részletesen vizsgáltuk az algatársulások változásait, amelyek ugyancsak alátámasztják azt a tényt, hogy az algák nemcsak ásványi sókat, hanem a bomló szervesanyagokból aminosavakat szénhidrátokat, vitaminokat és növényi hormonokat is képesek felvenni. Ezt az algák indikátor értékének megállapításánál figyelembe kell venni.

A saprobitás és trophitás nemcsak azáltal függenek össze, hogy a saprobitást előidéző szerves anyagok mineralizálódva a trophitás fokát növelik, hanem úgy is, hogy e szerves anyagok némelyikét az algák közvetlenül inkorporálni képesek. Ez a részleges heterophia speciesen belül is eltérő lehet, azaz bizonyos szelektivitás is mutatkozik. Mindezek figyelembevételével az indikátor szervezetek értékelése s ezen át a biológiai vízminősítés reálisabb lehet.

Sistem i sezonske zajednice algi u mrtvajama reke Tise Körtvélyes i Mártély

Kiss I.

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Abstrakt

Istraživanja algi u mrtvajama reke Tise kod naselja Mártély i Körtvélyes vršili smo u više navrata. Došlo je do eutrofizacije oba basena, naročito u mrtvaji Mártély. U mrtvaji Körtvélyes od 1981. godine uočljivo je relativno učešće velikog broja Euglenophyta species, koji ukazuju na prisustvo djubriva u prispelim otpadnim vodama (Tabl. 1). Utvrdjene promene zajednice algi takodje potvrdjuju činjenicu da su alge u stanju da pored mineralnih soli korite i aminokiseline, ugljene hidrate, vitamine i biljne hormone u toku procesa raspadanja organskih materija. Ovu činjenicu treba imati u vidu pri utvrdjivanju indikatorne vrednoati algi.

Uzajamna uslovljenost saprofitosti i trofičnosti ne javlja se samo usled mineralizacije organskih materija, več i putem direktne inkorporacije nekih organskih materija od strane algi. Ova delimična heterotrofija i intraspecijski može biti različita. Na osnovu ovih zapažanja, kako vrednovanje indikatornih organizama, tako i biološka ocena kvaliteta voda dobija u realnosti.

ВОДОРОСЛИ И ИХ СЕЗОННЫЕ СООБЩЕСТВА В СТАРИЦАХ ТИСЫ КЁРТВЕЙЕШ И МАРТЕЙ

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Резюме

Водоросли реки Тисы в нескольких циклах были изучены в старицах рек возле населенных пунктов Мартей и Кёртвейеш. Обе воды в этих старицах эутрофные, особенно в старице Мартей. В таблице 1% I хорошо видно, что в старице Кёртвейеш с 1981 года большую роль сыграли евгленовые, что показывает на то, что в этих местах сточные воды несут в себе смытые удобрения. Ознакомивши в детале со сменами водорослевых ценозов, пришли к заключению, что водоросли способны усвоить не только минеральные соли, но и вещества из распавших органических материалов — аминокислот, углегидратов, витаминов и раститель ных гормонов. Всех это следует учесть при определении оценки водорослевых индикаторов.

Сапрофитизм и трофитизм зависимы от друга не только точому, что сапрофитизм проявляющие органы, вещества минерализацией увеличивают степснь трофитизма, но и потому, что некоторые водоросли органические вещества сособны непосредственно инкорпофировать. Эта частичная специальная гетеротрафия может иметь и внутренные расхождения и тем самым производят определенную селекцию.

Учитывая все эти явления, оценка структуры индикатора и через них биологическая оценка воды может быть более реальной.